ATTACHMENT 2

TELECOM DEREGULATION AND THE ECONOMY: THE IMPACT OF "UNE-P" ON JOBS, INVESTMENT AND GROWTH

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Executive Summary

The increasing importance of the Information Technology (IT) sector to the U.S. economy is widely recognized. Economists credit the Internet-driven IT boom for the rapid growth of the late 1990s, and the sector's difficulties are seen as one of the leading causes of the 2001 recession and subsequent economic sluggishness. Numerous studies have demonstrated that investment in telecommunications infrastructure and other forms of information technology is the primary cause of the acceleration in productivity growth, which began in the late 1990s and has continued, unabated, to the present.

Economists also recognize that government policies have a major impact on the performance of the heavily regulated telecommunications sector. The Federal Communications Commission and state public utility commissions continue to regulate telecommunications prices at both the retail and wholesale levels, and to impose upon incumbent carriers a complex array of sharing requirements. These rules, known as the "Unbundled Network Element" or "UNE" rules, require incumbent firms to lease their facilities to competitors at prices specified by the FCC and state commissions. One form of UNE, "UNE-P," allows competitors to lease virtually all of the facilities needed to provide service, thereby avoiding the need to make any significant investment of their own. Many economists believe these rules discourage investment in new facilities.

Economic theory suggests that firms will invest in new facilities only to the extent they believe the net present value of the returns from those facilities exceeds the cost. If the UNE regime forces incumbents to lease facilities at prices below cost, neither incumbents nor competitors will have an incentive to invest in new infrastructure.

In this study, we examine the empirical evidence on the impact of UNE rules on telecommunications investment. While the studies we review utilize different techniques, rely on different data and analyze different variables, they are nearly unanimous in finding that the UNE regime does indeed deter investment.

Our contribution is two-fold. First, we compile the results of the major existing empirical studies to produce estimates of the annual impact, in billions of dollars, of UNE rules on capital expenditures. We find that the impact is significant: As shown in the table below, current UNE rules reduce telecommunications investment by as much as $12.74 billion each year.

Estimated Impacts of UNE Reform on Annual Telecom Investment

Industry Sector	Annual Impact on Investment	
	Downside Case	**Upside Case**
Fiber to the Home	$1.95 billion	$2.57 billion
CLEC Facilities-based Lines	$0.19 billion	$1.65 billion
ILEC Net Plant (Including DSL)	$3.00 billion	$3.00 billion
High-Speed Lines (Other than DSL)	$0.23 billion	$5.52 billion
Total	**$5.37 billion**	**$12.74 billion**

Second, using estimates provided by the Department of Commerce, we estimate the impact of increased telecommunications sector investment on overall economic performance, specifically gross domestic product and employment. We estimate that UNE reform would increase GDP by between $14.3 billion and $33.9 billion, and create between 94,000 and 223,000 jobs, in the first year after adoption. In three years (i.e. by year-end 2005), GDP would rise by between $42.9 billion and $101.7 billion, and the economy would have created between 282,000 and 669,000 additional jobs. By comparison, if Congress were to adopt the Bush Administration's recently-announced tax package *in toto*, the White House projects it would increase GDP by $40 billion in 2003 and create 2.1 million new jobs over three years.

The major implication of this research is that the Federal Communications Commission, which currently is considering revisions in the UNE rules, should recognize that its actions could have a significant positive impact on macroeconomic performance over the next several years. Conversely, indecision or delay will measurably harm the economy: A one-year delay would cost as many as 223,000 jobs in 2003; delaying for two years would reduce employment by up to 450,000 jobs in 2004; and so forth. For those used to seeing telecommunications regulation as a "microeconomic" issue, it is time to think again. We live in a digital economy, no longer driven by oil and steel, but instead by information technology and its key infrastructure provider, the telecom sector.

I. Introduction

In 2000, after five extraordinary years of growth, the U.S. economy turned sluggish. While the statisticians are still debating the length of the "recession" – indicated by actual shrinkage in Gross Domestic Product – there is no question that economic growth has lagged well behind its long-run potential. Few observers expect a substantial rebound in 2003, and some believe the economy could even slip into a "double-dip" recession.

These results have come despite the best efforts of policymakers to stimulate a more rapid recovery. Most notably, the Federal Reserve has pushed interest rates to historic lows, and the Bush Administration pushed for and won Congressional approval for significant tax cuts. While there is no doubt these measures have helped to minimize the depth and length of the slowdown, they have not been successful in reversing it. Further measures to stimulate the economy are on the front burner as Congress returns to work this month.

One area in which policy has not changed significantly is in the regulatory treatment of the telecommunications sector, particularly with respect to the framework of unbundling and sharing obligations placed on wireline telecommunications carriers by the Federal Communications Commission. Those rules, adopted originally in August 1996 and modified several times since, require incumbent telephone companies to lease their facilities to competitors at prices below actual costs.

At first blush, such arcane regulatory matters may seem unimportant when compared with the "larger" issues of interest rates, tax cuts and fiscal stimulus. But closer examination reveals that the telecommunications sector has played a disproportionately large role in the economy in recent years, contributing far more than its share to the rapid growth of the 1990s and, conversely, playing a central role in the recent downturn. Reversing what has come to be known as the "telecom meltdown" is thus crucial to a strong recovery. Indeed, tech-sector analyst George Gilder has even suggested that Federal Communications Commission Chair Michael Powell's "leadership and decisions . . . will have more impact on the economy than those of Federal Reserve Chairman Alan Greenspan."[1]

The FCC is now on the verge of reforming its unbundling rules (known as UNE or UNE-P, for "unbundled network element" or "unbundled network element-platform"). Most believe the Commission will vote to reduce regulation of the incumbent carriers, a move designed in part to spur investment. But the rules are complicated, and the effectiveness of the new policy will be determined significantly by how the Commission resolves several key issues. Among the questions facing the Commission is the extent to which sharing obligations will be scaled back, the role of the states (which, if not pre-empted, could delay or dilute the impact of the Commission's decisions), and the timing

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[1] George Gilder and Bret Swanson, "The Broadband Economy Needs a Hero," *Wall Street Journal* (February 23, 2001), p. A14.

of implementation (which could be immediate or, alternatively, phased in over several years).[2]

In this paper, we examine the potential impact of the Commission's forthcoming actions on the overall performance of the United States economy. Relying on publicly available data, we provide estimates of the potential impact of UNE reform on jobs, investment and GDP. Further, we provide estimates of how these effects are likely to be spread out over time, thus permitting an assessment of the impact on near-term economic performance associated with any delays in implementation.
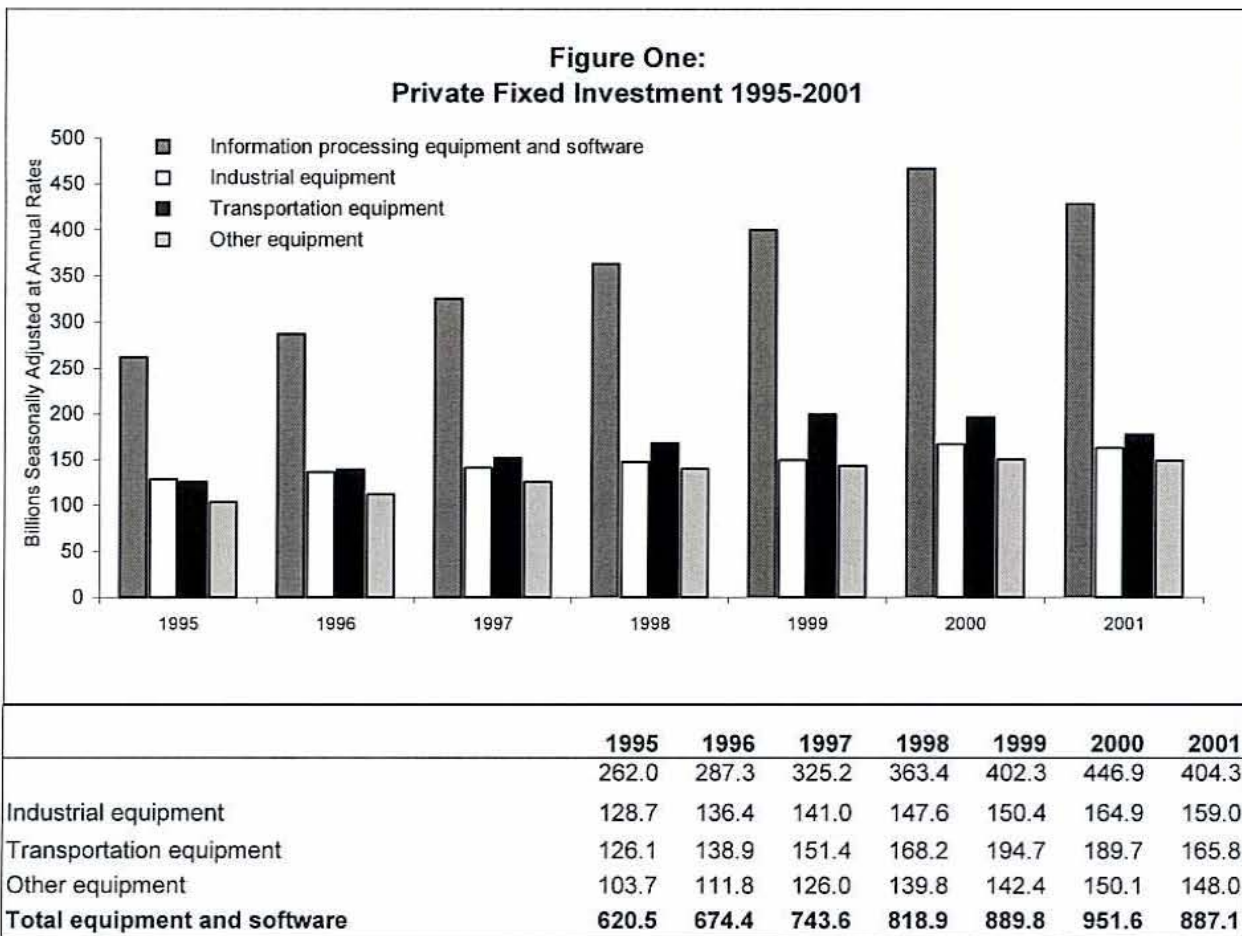
Overall, we project that immediate elimination of obligations to provide unbundled network elements at below cost rates would raise GDP growth by between $14 and $34 billion this year, and create 282,000 to 669,000 jobs over the next three years. By comparison, the White House projects President Bush's tax cut proposal, if enacted by Congress, would generate $40 billion in additional 2003 GDP growth and create 2.1 million jobs over three years.

The remainder of this paper is organized as follows. Section II discusses the role the telecommunications sector (and, more broadly, the IT sector as a whole) plays in the economy, focusing particularly on the sector's performance during the past decade. Section III explains the UNE regulatory regime and reviews the available evidence on the relationship between UNE and telecom sector performance, especially with respect to its negative impact on capital expenditures by both incumbents (ILECs) and new entrants (CLECs). Section IV provides a range of empirical estimates of the impact of the UNE regime on telecom sector investment as well as empirical estimates of the resulting impact on overall economic growth. Section V offers some concluding comments.

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[2] See Randolph J. May, "The FCC and Telecom Recovery: A Scorecard for Evaluating the New Rules," *Progress on Point 10.2*, January 2003.

II. The Telecom Sector, IT and the Economy

From 1996 to 1999, real gross domestic product increased at an annual rate of almost five percent, up from 2.75 percent for the first half of the decade. During the same period, labor productivity, the source of higher wages and better living standards, increased at more than 2.5 percent annually, nearly double the pace of the previous 25 years.[3] Most economists attribute this rapid growth to investments in the information technology and telecommunications sectors.[4] As illustrated in Figure One, capital expenditures (CAPEX) on IT equipment and software increased by over 70 percent between 1995 and 2000, while non-IT equipment spending increased only 41 percent.

Figure One:
Private Fixed Investment 1995-2001

	1995	1996	1997	1998	1999	2000	2001
	262.0	287.3	325.2	363.4	402.3	446.9	404.3
Industrial equipment	128.7	136.4	141.0	147.6	150.4	164.9	159.0
Transportation equipment	126.1	138.9	151.4	168.2	194.7	189.7	165.8
Other equipment	103.7	111.8	126.0	139.8	142.4	150.1	148.0
Total equipment and software	**620.5**	**674.4**	**743.6**	**818.9**	**889.8**	**951.6**	**887.1**

Source: Bureau of Economic Analysis

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[3] See Jeffrey Eisenach, Thomas Lenard and Stephen McGonegal, *The Digital Economy Fact Book, Third Edition, 2001,* The Progress & Freedom Foundation, pp. 79, 84.
[4] See Dale W. Jorgenson, "American Economic Growth in the Information Age," *Progress on Point 9.12,* April 2002.
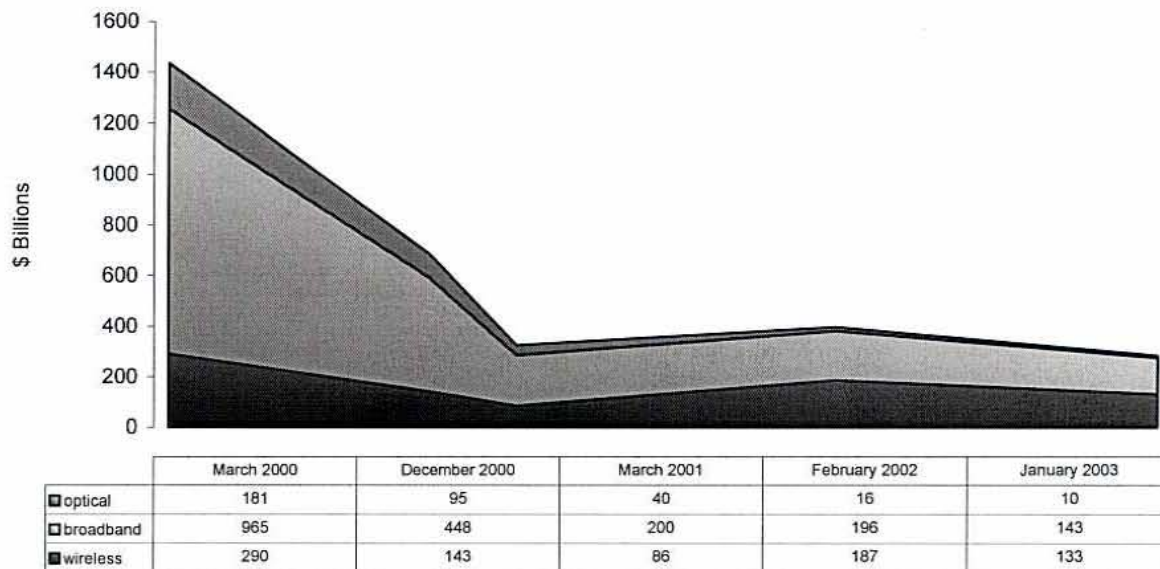
Investment in the telecommunications infrastructure played a central role in this growth, not least by enabling the growth of the Internet and connected computing. As Federal Reserve Board Chairman Alan Greenspan put it, "Until the mid 1990's . . . computers were still being used on a stand-alone basis. The full value of computing power could be realized only after ways had been devised to link computers into large-scale networks."[5] The Bureau of Economic Analysis reports that total spending on communications equipment jumped from $65 billion in 1996 to $117 billion in 2000 – an average annual rate of 15 percent.

As is now well known, the "telecom meltdown," which began in 2000 and continues to the present, brought a dramatic reversal in these trends. As shown in Figure Two, communications equipment investment fell by 22 percent between 2000 and 2001, despite continued demand for broadband services and continuing growth of the Internet. Telecom equipment makers were hard-hit as a result and, as shown in Figure Three, the market valuation of the telecom equipment sector fell from $1.4 trillion in March 2000 to $327 billion a year later.

Figure Two:
Year-on-Year Change in Communications Equipment Investment (1990-2001)

Source: Bureau of Economic Analysis

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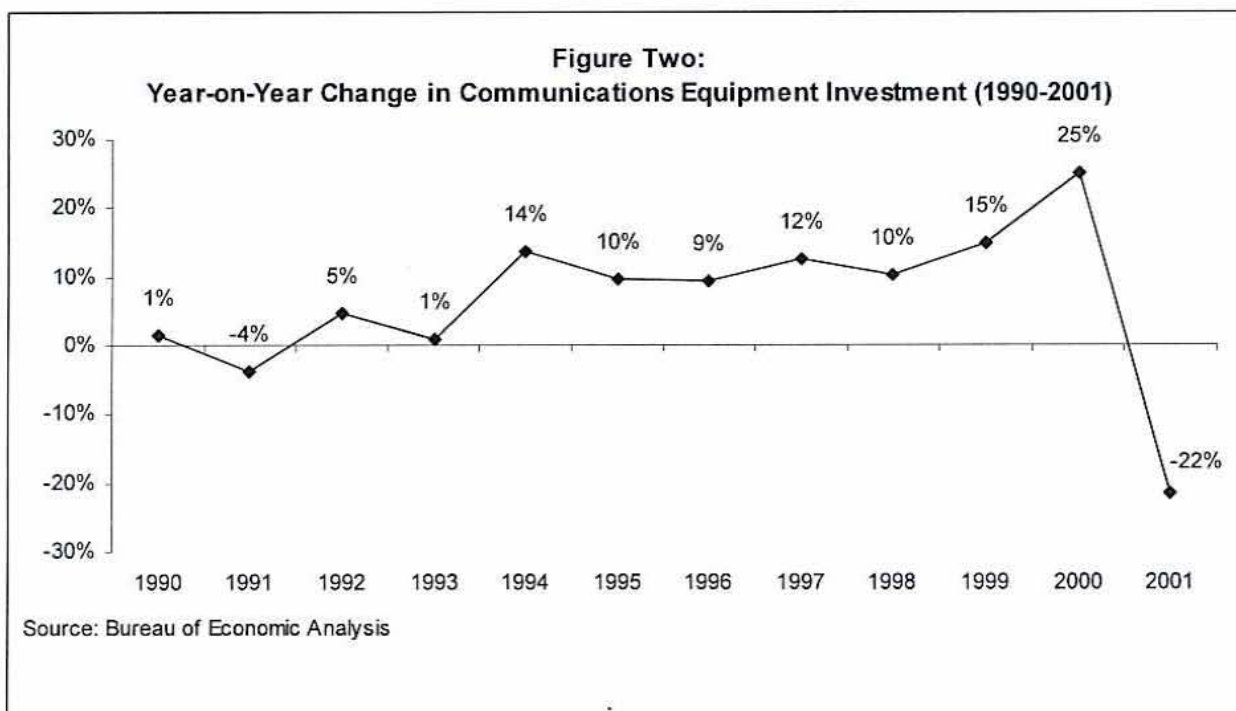
[5] Remarks of Alan Greenspan, "Technology Innovation and Its Economic Impact" before the National Technology Forum, St. Louis, MO (April 7, 2000).
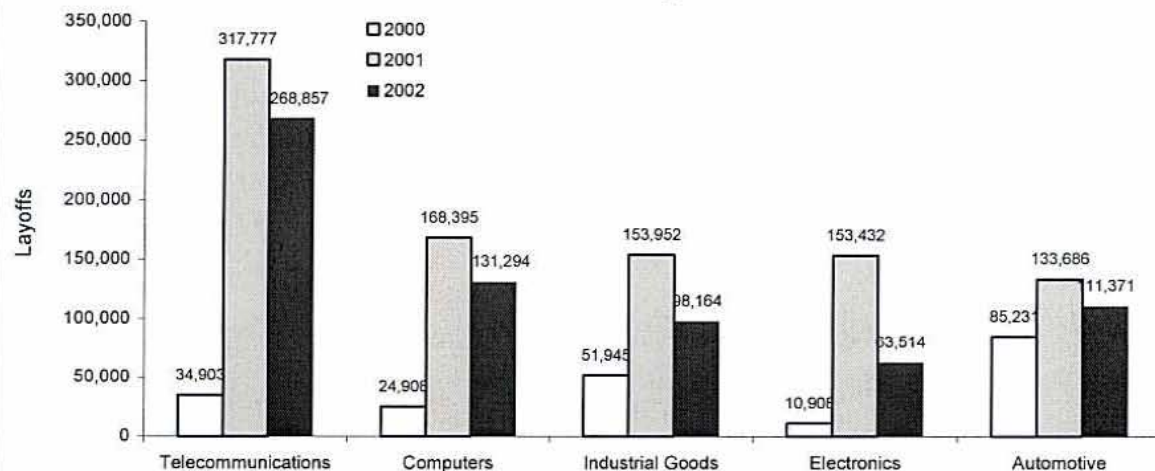
Figure Three:
Telecommunications Equipment: Market Valuation

	March 2000	December 2000	March 2001	February 2002	January 2003
☐ optical	181	95	40	16	10
☐ broadband	965	448	200	196	143
■ wireless	290	143	86	187	133

Source: Crossroads, LLC

As illustrated in Figure Four, the costs of the telecom meltdown were not limited to companies and their investors. To the contrary, the telecommunications sector has suffered far more job losses – more than 600,000 since 2000 – than any other major sector of the U.S. economy.

Figure Four:
Industries Hardest Hit by Job Cuts

☐ 2000
☐ 2001
■ 2002

Telecommunications: 34,903 / 317,777 / 268,857
Computers: 24,908 / 168,395 / 131,294
Industrial Goods: 51,945 / 153,952 / 98,164
Electronics: 10,908 / 153,432 / 63,514
Automotive: 85,231 / 133,686 / 111,371

Source: Challenger, Gray and Christmas Inc.

There is a broad consensus that the developments described above played a significant role in the current downturn. Indeed, "the collapse of the high-technology sector" was listed by the Council of Economic Advisers as one of five major causes of the current slowdown.[6] By the same token, reviving capital spending in the telecom and IT sectors is central to a robust and lasting economic recovery. As the discussion below suggests, in fact, it may be the single most important thing policymakers could do to get economic growth back on track.

III. The Impact of Regulation on Telecom Investment

No doubt many factors played a role in the (perhaps overly) rapid rise in telecom investment and its subsequent collapse. Certainly investors were overly enthusiastic about tech stocks in general, and in many cases were too quick to provide capital to firms that lacked solid business plans or strong prospects for success. Regulators seem to have fallen into the same trap, encouraging too many new players to enter telecom markets and writing rules designed to help them do so. Massive investments in high-capacity Internet backbone facilities created a "fiber glut" in long-haul facilities, while a variety of factors – regulation again among them – helped slow the build-out of the crucial last mile. No single cause, but rather a confluence of factors, conspired to produce a "bubble" that some observers have called "the perfect storm."[7]

Post mortems aside, the challenge policymakers face today is to identify steps to reverse the telecom sector's decline and restore investment to healthy and sustainable levels. In this section, we examine the evidence relating to the impact on investment of the current regulatory regime governing the unbundling and sharing of telecommunications facilities by ILECs. As noted above, the FCC is currently considering significant changes in these rules. The evidence presented here suggests that such changes would indeed have a substantial positive effect on telecom sector investment.

The UNE/TELRIC Regulatory Regime: The 1996 Telecommunications Act requires the ILECs to unbundle and lease elements of their local networks to new entrants if access to those facilities is "necessary" and the lack of access would "impair" the ability of a competitor to provide the services that it wants to offer. As implemented by the FCC and the states, the list of elements that must be unbundled (unbundled network elements, or "UNE's") is determined by the FCC, with wholesale prices determined by the states using the total element long-run incremental cost ("TELRIC") methodology adopted by the FCC. Generally, competitors are allowed to lease a subset of the unbundled elements or all of them together. By leasing all of the UNE elements as a "platform," (referred to as "UNE-P") competitors can provide customers

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[6] Council of Economic Advisers, *Economic Report of the President* (February 2002), p. 36. For a more complete review of the telecom meltdown and its impact on the economy, see Thomas M. Lenard, "The Economics of the Telecom Meltdown," The Progress & Freedom Foundation, *Progress on Point 9.6*, February 2002.

[7] Larry F. Darby, Jeffrey A. Eisenach and Joseph S. Kraemer, "The CLEC Experiment: Anatomy of a Meltdown," *Progress on Point* 9.23, September 2002.

with a complete package of telecommunications services without making any significant investment in facilities.

The idea behind the UNE/TELRIC regime is to give competitors access to network elements that cannot economically be replicated (i.e. for which economies of scale or scope make competition unfeasible), while encouraging them to compete by building their own facilities where it is possible to do so. If regulators err by unbundling too few elements, or setting wholesale prices too high, competitors will not enter. If too many elements are unbundled and prices are set too low, on the other hand, the incentive for both incumbents and entrants to build new facilities is weakened or even eliminated altogether: Incumbents will not invest in new facilities if they are forced to sell them at prices that do not allow them to recover their costs and make a fair return, and new entrants will not invest in facilities if they can lease them from incumbents for less than the cost of buying them.[8]

The idea behind TELRIC was to set prices based on "forward looking" costs – i.e. the costs of replicating the network using the best available technology. And, since technology is constantly improving, the forward-looking price should decline (by an annual "X-factor") to reflect rising productivity and falling costs. While theoretically plausible, there is a substantial body of evidence that the TELRIC model, in practice, has resulted in prices being set at levels that have substantially impaired investment – i.e. prices that are not only below book costs, but also below the true "forward looking" cost faced by either incumbents or new entrants.

UNEs, TELRIC and Book Costs: According to a study by Dale Lehman, UNE rates initially averaged around $5 a month – or about 25 percent – below actual, embedded costs.[9] Lehman notes that given the average "X-factor" adopted by state commissions, it would take at least 28 years for incumbents to bridge the gap between their embedded costs and the "forward looking" costs embodied in the initial UNE rates set by the states.[10] As he observes:

> It is...difficult to believe that regulators could find that the actual embedded cost of the regulated incumbents average 25% more than an efficient level of costs. After all, these are the same regulators that conduct prudency reviews under rate of return regulation, the same regulators that found current retail rates an acceptable starting point for establishing price cap regulation, and the same regulators that were not able to cite any specific inefficient practice on the part of incumbents.[11]

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[8] See, however, the discussion below of the novel theory advanced by economists Kevin Hassett, Robert Willig and others, which suggests that profitability is not a major factor in ILEC investment decisions.
[9] See Dale E. Lehman, "The Court's Divide," *Review of Network Economics*, (September 2002), p. 108, and Lehman, D.E. and Weisman, D. *The Telecommunications Act of 1996: The "Costs" of Managed Competition*, Kluwer Academic Publishers (2000).
[10] Moreover, the gap between UNE rates and embedded costs was larger in price-cap than in rate-of-return states, a surprising result since the primary intent of price-cap regulation is to provide incentives to minimize costs and produce efficiently. One would therefore expect embedded costs and efficient forward-looking costs to be closer together in those jurisdictions.
[11] Lehman (2002), p. 110.

If UNE rates were indeed set too low when they were initially put in place (generally in 1997-1999), they have fallen significantly since. Table One shows UNE-P prices for the Regional Bell Operating Companies in relation to operating costs and revenue per line as of 2001.[12] For example, the table shows that an entrant could lease a Full UNE-P from Bell South for $26.61 a month. The operating costs (cash costs plus depreciation and amortization) for that line were $45.01. Thus, leasing that line to a competitor resulted in an operating loss of $18.40 a month. Since Bell South could earn revenues of $62.65 by selling the service to the end consumer, the true "opportunity cost" of selling at the UNE-P price was over $36 per month. SBC situation's was even worse: By 2001, UNE-P prices were covering only 49 percent of its embedded costs, and only 39 percent of the revenue it would have received had it continued to sell the line – at the state-regulated retail price – to the end customer.

Table One:
**UNE-P Prices in Relation to the RBOC's Financial Books**

	BellSouth	Qwest	SBC	Verizon
Basic UNE-P	$20.97	$26.80	$19.88	$24.14
Basic UNE-P + features	$21.67	$28.79	$20.96	$24.20
Full UNE-P	$26.61	$29.49	$22.10	$24.31
Average revenue per line*	$62.65	$56.45	$57.37	$57.55
Average cash cost per line*	$31.79	$32.76	$32.59	$33.26
Average depreciation and amortization/line	$13.22	$11.77	$12.55	$11.50
Average total operating cost per line*	$45.01	$44.52	$45.14	$44.76
Full UNE-P as % revenue	42%	52%	39%	42%
Full UNE-P as % total operating cost	59%	66%	49%	54%

Sources: Anna-Marie Kovacs, et al, "Status and Implications of UNE-Platform in Regional Bell Markets", Telecommunications and Broadband Services Industry Report, Equity Research Group of Commerce Capital Markets, Philadelphia, PA, November 12, 2001. Based on company reports and Commerce Capital Markets estimates. BLS, SBC, and VZ information as of Q3'01. **Q information as of Q4'99**.

In 2002, UNE prices continued to fall, in part due to the insistence of state regulators that incumbents further lower their wholesale prices in order to gain entry into long distance markets as part of the "271 process." Data on recent levels of UNE rates collected by the National Regulatory Research Institute are presented in Figure Five. The data show that just in the last year, the average UNE-P rate has gone down 15 percent, while the average UNE loop rate has gone down more than 10 percent. Based on Lehman's estimate that the initial state-set UNE loop rates averaged $17.24 per month, the NRRI data implies rates have fallen more than 25 percent since they were first put in place.[13]

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[12] Except for Qwest data, which are for Q4'99.
[13] Lehman (2002), p. 108.

Figure Five:
Basic Une-P and Loop Rate
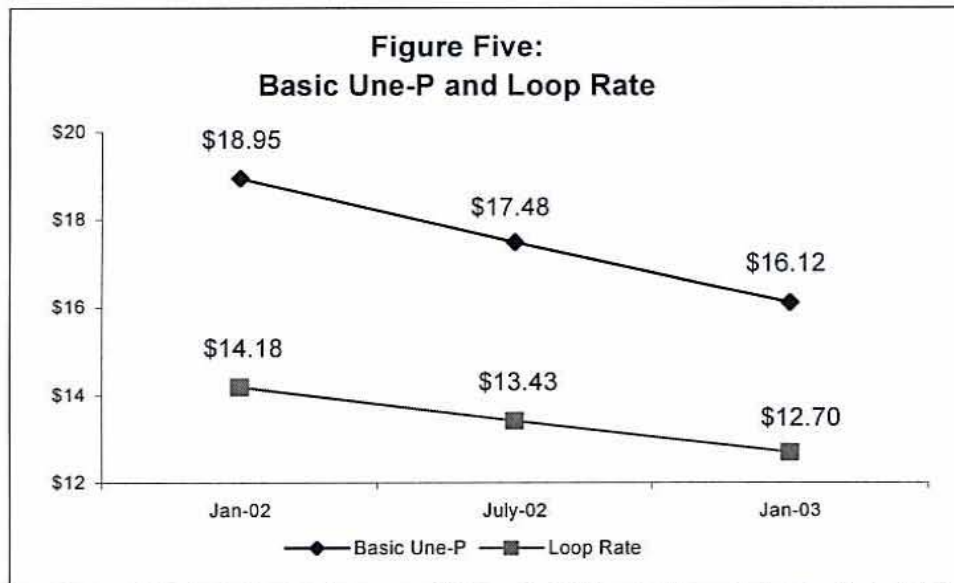
Source: Billy Jack Gregg, *A Survey of Unbundled Network Elements In The United States*
(National Regulatory Research Institute, July 2002, January 2003).

In sum, the UNE policies currently imposed by the FCC and state regulators require incumbent companies to lease virtually all of the facilities needed to provide local telephone service to competitors at prices that currently cover 50 percent or less of the incumbents' actual costs.

UNEs and Investment: Of course, TELRIC was designed to produce prices that reflected not actual, historical costs, but "forward-looking" or prospective costs – plus a mark-up to allow a reasonable rate of return. While the TELRIC-based UNE regime is thus designed to require sharing at prices below actual "book" costs, they should still provide an incentive for both incumbents and entrants to invest in new facilities.

There is a broad and growing body of empirical research suggesting that current UNE policies deter investment. This research is grounded in generally accepted economic theory, which suggests that firms' investment decisions are determined by the expected "net present value" (NPV) of the investment: Simply put, firms will invest in new facilities when they believe they can make money from doing so.[14] A number of recent studies, utilizing a diverse array of analytical approaches, examine the hypothesis that current UNE policies reduce the NPV of telecommunications infrastructure investment and thus deter CAPEX in the telecom sector. With only one notable exception, virtually all of these studies find support for this hypothesis.

Based on an analysis of the economics of DSL deployment, a paper by Haring and Rohlfs concludes that the network unbundling requirements have made widespread deployment of DSL by the ILECs unprofitable and have reduced investment in DSL by

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[14] For a full discussion of the net present value model, see Randolph J. May and Larry Darby, Comments of The Progress & Freedom Foundation to the FCC (CC Dockets No. 01-338, 96-98 and 98-147), April 5, 2002, pp.15-31.

at least $6 billion and possibly more than $20 billion.[15] The Haring-Rohlfs study stresses the critical point that the telephone companies are operating in highly uncertain and risky markets. In order for companies to invest in projects where there is a significant probability of failure, there must also be an opportunity to earn profits that are above competitive levels. Otherwise, no investment will take place. Even without UNE-based CLEC competition, the DSL market is very uncertain. But, the ILECs are also faced with the prospect that, if a potential DSL investment turns out to be successful, the CLECs will be able to lease the ILECs' facilities and undercut their prices. Under these circumstances, it is quite rational for the ILECs to be cautious (SBC withdrew from its Project Pronto and other ILECs also scaled back their DSL investment programs) and, indeed, it would be irresponsible and against the interests of their shareholders to act otherwise.   Haring-Rohlfs quote Malcolm Andrew, Senior Policy Advisor, Telecommunications Policy Branch, Industry Canada, who sums up the situation this way:

> The current regulatory regime thus offers incumbent telcos a "coin flip" any rational economic actor would presumably prefer not to make: if their risky investments in new technology turn out to be an "incomplete success," they and their shareholders are left holding the proverbial bag; if the risky investments turn out to be a (complete!) success, the regulator's technology "sharing" rules rule out big rewards sufficient to warrant the requisite risk-taking in the first place. It is a clear case of "heads, you lose" and "tails you don't win," so why bother?[16]

The Haring-Rohlfs study is consistent with the results of a study by Cambridge Strategic Management Group (CSMG) undertaken for Corning.[17] CSMG evaluated the business case for Fiber to the Home (FTTH) for representative ILEC central offices (COs) based on a ten-year profile of revenues and capital and operating costs. Not surprisingly, CSMG found that regulation increased costs and lowered the revenue potential of FTTH. The study found that FTTH would be economically feasible – i.e., have a positive net present value – in eight percent of COs corresponding to 31 percent of households in the unregulated scenario. Under mandated unbundling FTTH would be economically feasible in only one percent of COs corresponding to five percent of households. This 26-point reduction in coverage corresponds to a reduction in capital expenditures of $39 billion over ten years.

Using a different technique – a "qualitative response" regression model – David Gabel, Guang-lih Huang and Eugene Floyd show how regulation (among other factors) affects the deployment of advanced telecommunications services by ILECs.[18] Again,

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[15] John Haring and Jeffrey H. Rohlfs, "The Disincentives for Broadband Deployment Afforded by the FCC's Unbundling Policies," Strategic Policy Research, April 4, 2002. This paper was attached to the Comments of the High Tech Broad Coalition (CC Dockets No. 01-338, 96-98 and 98-147) April 5, 2002.
[16] Haring and Rohlfs, p. 22.
[17] "Assessing the Impact of Regulation on the Deployment of Fiber to the Home – A Comparative Business Case Analysis," Cambridge Strategic Management Group, April 5, 2002.
[18] David Gabel, Guang-lih Huang and Eugene Floyd, "An Econometric Analysis of the Factors that Influence the Deployment of Advanced Telecommunications Services," January 2003. Gabel and Huang are with MIT, ITC and Floyd is with the City University of New York.

not surprisingly, they find that ILECs are more likely to invest in advanced services the higher the ratio of the UNE price to the embedded cost of the service. They also find that the presence of facility-based competitors raises the likelihood that ILECs will make such investments. As economic logic would suggest (and as the evidence discussed below shows), mandatory unbundling discourages facilities-based competition. Thus, there are two mechanisms by which eliminating mandatory unbundling would encourage investment.

A study by Haring, Rettle, Rohlfs and Shooshan uses a cross-section regression model to determine the effect of regulation on ILEC investment. Using 2001 statewide data and a model in which the dependent variable is RBOC net plant, they find that RBOC investment decisions are driven by four factors – the number of loops served by the RBOC in the state, the 2001 state unemployment rate, the 2001 gross state product and the UNE loop price in RBOC zone 1 multiplied by the number of RBOC loops. They test several variations on the model and find it to be robust.

Haring *et al* find that the UNE loop price is positively related to ILEC investment, the result one would expect from economic theory. The UNE loop price variable is both statistically significant (at the one percent level) and economically significant. A one dollar increase in the loop price increases net plant by about $18 per loop. Thus, as we discuss below, the aggregate effect on investment of either raising the UNE prices or lifting the mandatory unbundling requirement would be quite substantial.

The Haring *et al* model is part of a paper that critically evaluates an econometric study by Robert Willig and his colleagues that was attached to AT&T comments submitted to the FCC.[19] The Willig paper, as well as a paper by Kevin Hassett, make the counterintuitive argument that lower UNE prices actually *increase* investment in facilities.[20] The authors of these papers theorize that lower UNE prices stimulate competition, which in turn reduces retail prices from the "monopoly" level charged by incumbents, which in turn increases total output, which in turn requires increased investment. These papers have been widely and effectively critiqued on econometric and theoretical grounds elsewhere,[21] and it is not our purpose to do so here. The reader should be aware of two points, however.

First, the key assumption behind this theory – that the prices currently charged by incumbents are "monopoly" prices – is at variance with reality. In the real world, retail prices are set by state regulators, who are charged with setting them, on average, at or near the level that would prevail in a competitive marketplace. Investment in new,

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[19] Declaration of Robert D. Willig, Attachment F to Comments of AT&T Corporation, CC Docket Nos. 01-338, 96-98 and 98-147, April 5, 2002.

[20] See Kevin A. Hassett and Lawrence J. Kotlikoff, "The Role of Competition in Stimulating Telecom Investment," (Manuscript, October 2002). See also Robert D. Willig, *et al*, "Stimulating Investment and the Telecommunications Act of 1996," (Manuscript, October 2002). The Willig paper includes an empirical analysis; the Hassett/Kotlikoff paper presents results from a "simulation" which is based on hypothetical, not actual, data.

[21] See, for example, Randolph J. May and Larry F. Darby, Reply Comments of The Progress & Freedom Foundation to the FCC (CC Dockets No. 01-338, 96-98 and 98-147), July 17, 2002.

more efficient facilities may indeed result from competition (certainly that is the goal), but the investment will be a cause of the lower prices, not, as Willig suggests, the effect.

Second, the Willig-Hassett theory simply ignores the net present value approach to determining investment – which is to say that it ignores the simple fact that all firms must earn a positive return on invested capital. In the real world, as many of the CLECs recently have demonstrated, firms that fail to follow this rule incur losses and eventually go out of business. Indeed, the CLEC experiment is a perfect example of what happens when firms adopt business plans based on the Willig-Hassett approach: Too many firms enter too many markets investing too much capital and earning too little money – with inevitable and unpleasant results. Happily for investors, employees and consumers, the ILECs generally have spurned this approach, adhering to the more traditional concept that investment should be made in new facilities that *make money.* Everyone but their competitors should hope they continue to do so.[22]

Indeed, other research shows that CLECs ultimately do follow the net present value approach over time, investing in facilities only when they are unable to lease them from the ILEC for less than the risk-adjusted cost of building them. That is the result of a recent study by Crandall, Ingraham and Singer,[23] which concludes that "artificially low UNE prices induce CLEC's to defer facilities-based investments because the NPV [net present value] calculations of UNE leasing are higher than the NPV calculations of sinking capital into on-net assets." Indeed, using a cross-section regression model and state data, they estimate the (output constant) elasticity of substitution between facilities-based investment and UNE leasing at 1.23. This indicates that a one percent increase in the UNE price relative to the price of building a facilities-based line will yield a 1.23 percent increase in the ratio of facilities-based to UNE lines.

The Crandall *et al* results are supported by the results of a study by Eisner and Lehman, which uses a similar approach and looks at the effects of UNE prices, along with a number of other explanatory variables, on various forms of CLEC entry, including

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[22] In a revised version of their paper, Willig and his colleagues criticize the model developed by Haring et.al. for being "circular" because the dependent variable is RBOC net plant while one of the independent variables is the number of RBOC loops. (See Robert D. Willig, William H. Lehr, John P. Bigelow and Stephen B. Levinson, "Stimulating Investment and the Telecommunications Act of 1996," October 11, 2002.) Including loops is a way of incorporating the size of the telecom market the RBOC is attempting to serve. More importantly, BOC plant consists of a lot more than the number of loops. As the studies discussed above show, investments need for deployment of DSL, advanced services and FTTH are a key components of BOC CAPEX and are heavily impacted by UNE policies. The revised paper Willig paper estimates a "corrected version" of the Haring regression model, but the "corrected" version in fact has serious flaws. It relates net total per-capital plant in service to a number of economic and telecommunications variables, including TELRIC cost and the UNE price. But since UNE prices are set based on TELRIC costs, these two variables are highly correlated. The expected statistical effect of this misspecification is to divide the impact between the two variables, so that neither is statistically significant. And, indeed, they find that neither the TELRIC cost nor the UNE price variable is a statistically significant determinant of ILEC investment decisions.
[23] Robert W. Crandall, Allan T. Ingraham and Hal Singer, "Do Unbundling Policies discourage CLEC Facilities-Based Investment?, " November 27, 2002.

facilities-based entry.[24] Eisner and Lehman find that "states with lower UNE prices have less facilities-based entry."[25] Their results indicate that a dollar increase in the statewide average UNE rate yields an increase of 3,741 CLEC facilities-based lines per state.[26]

Finally, there is evidence that the effect of the UNE regime on investment is even broader. A paper by Lehman (which also estimates a cross-state regression model) contains estimates of the effect of UNE rates on investment in high-speed (i.e. broadband) telecommunications by all providers, including cable companies, and finds that the relationship is direct and statistically significant.[27] That is to say, lower UNE rates lead to less investment. This result is consistent with our expectations: By making scarce capital available in the marketplace at below-cost rates, UNEs make it impossible for companies that do invest in facilities to earn a fair rate of return, discouraging investment by all of them. The Lehman model predicts that each dollar increase in the UNE-P rate will yield 5,048 new high-speed lines.

IV. The Economic Consequences of UNE Reform

As discussed in Section II, increased capital spending on telecommunications equipment was a primary driver of the economic boom of the late 1990s, and its decline was one of the most significant causes of the 2001-3 slowdown. As shown in Figure Seven (below), telecom capital expenditures rose steadily from $42 billion in 1996 to $113 billion in 2000, but declined dramatically in 2001 and 2002. As the Manufacturers Alliance pointed out in a recent report:

> The decline in capital equipment [in 2001-2] was concentrated in computer and telecommunication equipment. . . . [C]omputer and telecom equipment accounted for 80 percent of the decline in monthly capital goods shipments since the May 2000 peak. One subgroup (nondefense telecommunication equipment) accounted for 44 percent of this decline, though it comprises less than 10 percent of capital goods shipments. This illustrates vividly the role of the "telecom meltdown" in the recession.[28]

It is useful for our purposes to look behind the underlying data. As shown in Table Two below, the declines in CAPEX during this period were widespread, affecting CLECs, IXCs (including AT&T and WorldCom, which are also the largest CLECs), ILECs, ISPs and cable companies. These data are consistent with the findings discussed above, which suggest that an overly expansive UNE regime would deter

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[24] James Eisner and Dale E. Lehman, "Regulatory Behavior and Competitive Entry," 14th Annual Western Conference, Center for Research in Regulated Industries, June 28, 2001.
[25] Eisner and Lehman, p. 4.
[26] Eisner and Lehman, Table 3, p. 10. We use the coefficient from equation 9. Eisner and Lehman estimate a number of variants of their model, all of which fit the data well and have similar coefficients for the UNE price variable.
[27] See Lehman(2000), p. 115.
[28] Jeremy Leonard, "Outlook for Capital Spending is Improving," Manufacturers Alliance/MAPI, July 9, 2002.

investment by all types of telecommunications providers, as well as with the fact that UNE rates declined significantly in 2000, 2001 and 2002.

Table Two:
Telecom CAPEX by Sector, 1996-2001

|	1996	1997	1998	1999	2000	2001
Local Exchange Carriers	18,138	20,125	21,592	27,446	30,972	29,392
CLECs	862	1,471	2,752	5,064	8,528	4,458
IXCs	16,634	21,620	26,447	35,097	50,956	39,105
ISPs	147	391	1,016	2,135	4,739	2,290
Cable Companies	6,681	6,484	9,046	12,595	17,920	17,338
U.S. Total	**42,462**	**50,091**	**60,852**	**82,337**	**113,115**	**92,583**
Growth		18.00%	21.50%	27.90%	37.40%	-18.20%

Sources: Telecommunications Industry Association, "Investment, Capital Spending and Service Quality in U.S. Telecommunications Markets: A Symbiotic Relationship," (July 9, 2002); Credit Suisse|First Boston.

Looking Ahead: Where is investment in the telecommunications sector headed? As a general matter, analysts are not optimistic about a near-term recovery, and those that are tend to base their predictions on decisive action by the FCC to reform the UNE regime.[29]

One authoritative report, published by Credit Suisse|First Boston, concludes there is a "meaningful probability" that overall telecom sector investment will continue to shrink, leveling off at around $35 billion annually.[30] (See Figure Six.) Under an optimistic set of assumptions, spending growth resumes beginning in 2004, reaching $54 billion by 2006. Under the "moderate" assumptions scenario, CAPEX in the telecom sector would reach $44.3 billion in 2006, leaving it virtually unchanged from its level a decade earlier.

[29] See, for example, Kathleen M. McQuade, "Lucent and Nortel Have a Future," Precursor Group, January 15, 2003. ("We also believe upcoming FCC telco deregulation will yield increased capex starting in late '03.")
[30] See "Telecom Equipment – Wireline Update," Credit Suisse/First Boston, September 26, 2002.

Figure Six:
Wireline Telecommunications Capital Spending, 1996-2006

*Projected
Source: Credit Suisse | First Boston
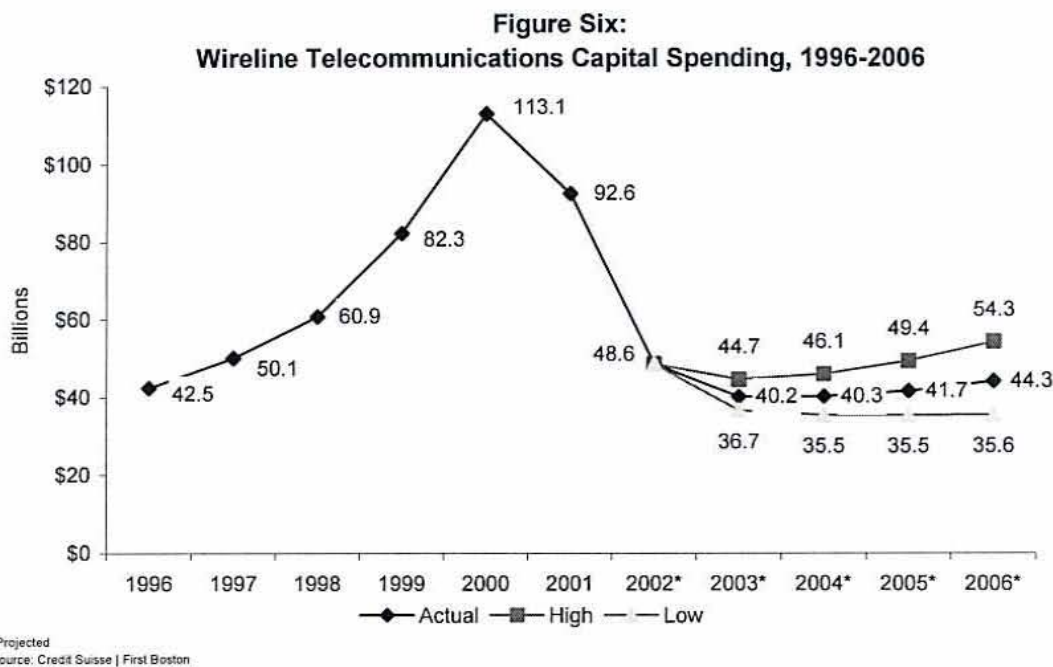
We present these data here primarily because they would seem to offer a plausible range of estimates for telecommunications sector CAPEX over the next four years. At a minimum, telecom companies should invest about $140 billion, at the most, about $190 billion. The difference, $50 billion, depends on a number of variables – one of which is the FCC's action with respect to reforming the UNE regime.

How important is the UNE decision to the future of CAPEX in the telecom sector? Our sense is that, even among those who have been critical of the UNE regime, most observers would tend to assume that its impact with respect to overall investment is relatively small relative to other factors, such as the overall performance of the economy. In what follows, we utilize empirical estimates from the papers reviewed above to address the issue analytically. Several of the studies provide direct estimates of the effect of the UNE regime on telecommunications investment, and estimates can be derived for the others. These estimates, in turn, allow us to estimate the approximate aggregate increase in telecom capital expenditures that can be expected from reforming or eliminating the UNE regime.

We also analyze the broader economic consequences that would follow from the increased CAPEX that would result from UNE reform. As with any increase in investment, the resulting increase in CAPEX in the telecom sector would have a cascading effect on overall economic growth, resulting in an impact on GDP substantially greater than the direct impact of the increased spending itself. The Department of Commerce publishes sector-specific "multipliers" that can be used to estimate these effects. As we show below, when the multiplier effect is taken into account, the overall economic effect of reforming the UNE regime would be quite significant.

Table Three summarizes the estimates of increased investment from UNE reform obtained from the studies reviewed in Section III. The estimates from the CSMG and Haring-Rohlfs studies are directly provided by those studies. The other studies estimate models from which we derive numerical estimates of the stimulus to investment. In deriving these estimates, we use as a proxy for "UNE reform" bringing UNE prices up to cost. Based on the data on average total operating costs per line from Table One, this implies an increase in UNE prices of about 75 percent. To estimate new investment for the studies that specify investment in terms of facilities-based or DSL lines, we use a cost per line of $1,500.[31]

Table Three:
Estimates of Increased Investment from UNE Reform

Study	Sector	Investment Category	Increased Investment ($billions)
Cambridge Strategic Management Group	ILEC	Fiber to the home	$39 (over 10 years)
Crandall, Ingraham & Singer	CLEC	Facilities-based lines	$1.9 to $3.5
Eisner and Lehman	CLEC	Facilities-based lines	$2.7
Haring, Rettle, Rohlfs & Shooshan	ILEC	Net plant	$30
Haring and Rohlfs	ILEC	DSL deployment	$6 to $20+ (over 3 years)
Lehman	All	High-speed lines	$4.6

Notes: CSMG and Haring-Rohlfs estimates are directly from the respective studies. The rest are derived as follows. Crandall et.al.: 311,420 (midpoint estimate of increase in facilities-based lines due to 10-percent UNE-rate increase) multiplied by either 4 (UNE rates would increase by 40% to be in line with average HCPM) or 7.5 (UNE rates would increase by 75% to be equal to average cost). Eisner-Lehman: 9.6 (increase in UNE-loop price to equal average cost) multiplied by 3741 (regression coefficient) multiplied by $1500 (cost of facilities-based line) multiplied by 50 (number of states). Haring et.al.: 9.6 (increase in UNE-loop price to equal average cost) multiplied by 18.05 (regression coefficient) multiplied by 167 million (number of ILEC lines). Lehman: 12.16 (increase in UNE-P rate to equal average cost) multiplied by 5048 (regression coefficient) multiplied by 50 (number of states).

Comparing the Estimates: In general, the studies summarized in Table Three estimate the effect of the UNE regime on different investment "stock" variables – e.g., net plant or the number of facilities-based or DSL lines – rather than on annual investment "flow" variables. If the UNE regime was reformed or eliminated, it would take a number of years for the new "equilibrium" capital stock to be reached. The CSMG study specifies a time period – ten years – over which the increased investment in FTTH would take place. The increased investment in DSL deployment from the Haring-Rohlfs study would presumably take place over three years, since that was the

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[31] This seems to be a conservative estimate. See Erick Schonfeld, "Fiber is Coming Home," *Business 2.0*, April 20, 2001, which indicates that hybrid fiber-coaxial cable, DSL and fiber-optic lines all cost significantly more than $1500.

expected duration of the (now cancelled) Project Pronto project upon which their estimates are based.

The other studies represent "point estimates" based on a snapshot in time: They tell us how the world would have been different at a particular moment under a different regulatory regime. In a "steady state" market, these would best be interpreted as one-time adjustments, which would be expected to be realized over a period of a few years. In a market experiencing secular growth – as is the case with both the market for broadband and the market for competitive telecommunication services – such point estimates underestimate the adjustment that would take place over time, which would grow approximately in proportion to the growth of the market.

A third factor that needs to be taken into account is that the studies estimate the impact of UNE policies on different aspects of telecom infrastructure. In some cases (e.g. CLEC facilities-based lines and ILEC Net Plant) the predicted impacts are mutually exclusive, and the estimates can therefore simply be added together. In others (e.g. DSL deployment and "all high speed lines"), there is an apparent overlap, and simply adding the numbers together would produce an overestimate of the total effect.

With these caveats in mind, we can derive a range of estimates for the impact UNE reform would have on annual investment in the telecommunications sector. We project two cases, an "upside case" and a "downside" case. In the downside case, we make assumptions we consider in some cases unrealistically conservative, including assuming longer (10-year) adjustment periods, no adjustments for secular growth in the broadband or CLEC markets, and high degrees of overlap among the estimates for various sectors. In the upside case, while our assumptions remain quite conservative, we allow for more realistic assumptions about adjustment periods (four years) and secular growth (using FCC statistics).

Table Four:
Estimated Impacts of UNE Reform on Annual Telecom Investment

Industry Sector	Annual Impact on Investment	
	Downside Case	**Upside Case**
Fiber to the Home	$1.95 billion	$2.57 billion
CLEC Facilities-based Lines	$0.19 billion	$1.65 billion
ILEC Net Plant (Including DSL)	$3.00 billion	$3.00 billion
High-Speed Lines (Other than DSL)	$0.23 billion	$5.52 billion
Total	**$5.37 billion**	**$12.74 billion**

To put these figures in context, it is useful to compare them with the CSFB projections of future telecom investment discussed above. (See Figure Six.) It will be recalled that the difference between CSFB's optimistic and pessimistic projections was approximately $50 billion over four years, or an average of $12.5 billion. Our estimates of the annual impact of UNE reform are broadly consistent with this range.

UNEs, Jobs and Growth: How do these estimates compare with other efforts to spur renewed economic growth? To estimate the overall impact on the economy of increased CAPEX in the telecom sector, we rely on the Department of Commerce multipliers. The multiplier is a standard concept in macroeconomic analysis.[32] As each additional dollar in final investment demand gets paid to workers and other inputs, and works its way through the economy, it will have a multiplicative impact on GDP. The final dollar impact is also associated with an increase in employment that depends on the industry sectors affected.

The Department of Commerce output and employment multipliers for communications equipment are 2.66 and 17.5, respectively.[33] Using these multipliers, we estimate that UNE reform would increase GDP by between $14.3 billion and $33.9 billion, and create between 94,000 and 223,000 jobs in the first year after adoption. Over three years (i.e. by year-end 2005), GDP would rise by between $42.9 billion and $101.7 billion, and the economy would have created between 282,000 and 669,000 additional jobs. (See Table Five). By comparison, if Congress were to adopt the Bush Administration's recently-announced tax package *in toto*, the White House projects it would increase GDP by $40 billion in 2003 and create 2.1 million new jobs over three years.[34]

Table Five:
Estimated Impacts of UNE Reform on GDP and Employment

Period	GDP ($billions)	Jobs (thousands)
First year	$14.3-33.9	94-223
First three years	$42.9-101.7	282-669
First five years	$71.5-169.5	470-1,115

In sum, while UNE reform may not compare with taxes and spending in its ability to make the front page of the newspaper, its potential impact on economic performance is on a par with the other policy levers currently being considered by policymakers.[35]

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[32] See, for example, Rudger Dornbusch and Stanley Fischer, *Macroeconomics*, (McGraw Hill, 6th edition, 1994), p. 66.

[33] These multipliers are from the Regional Input-Output System (RIMS) published by the Economic and Statistics Administration in the Department of Commerce. See RIMS II Multipliers, Table 1.4. The output multiplier indicates that each dollar of new telecommunications final demand generates $2.66 of new output. The employment multiplier means that each *million* dollars of new demand generates 17.5 new jobs.

[34] See Dana Milbank, "Bush Outlines Economic Plan," *The Washington Post*, January 8, 2003, p. A01; and "Background Briefing on the Growth and Jobs Plan," January 7, 2003, http://www.whitehouse.gov/news/releases/2003/01/20030107-3.html

[35] It should be noted that the estimates presented above are in many ways conservative. Two examples: First, we do not in any way account for the "catalytic" impact of increased broadband deployment on economic growth and productivity, despite the broad consensus among economists that IT investment has been a primary driver of increased productivity growth over the past decade. Second, we ignore the positive impact on the stock prices and market capitalization of telecom and related companies, which

V. Conclusion

In this paper, we compile existing estimates of the impact of UNE policies on telecommunications investment and, based on these figures, derive an estimate of the aggregate impact of UNE on investment, jobs and growth. Our results show that UNE reform is very much on a par with more traditional "macroeconomic" policy changes in terms of its potential to have a substantial impact on overall economic performance. Indeed, it compares favorably in its impact with the aggressive tax-cut package put forward by the Bush Administration.[36]

Just as with the proposed tax cuts, however, there is a fly in the UNE ointment: It is one thing to propose changes, and quite another to see them adopted. The estimates we present here, while quite conservative as a matter of analysis, may well prove overly optimistic as a matter of policy. With respect to UNE reform, this is true in two senses. First, the policy proposals now before the FCC are not perfectly captured by our "proxy" reform of raising UNE prices to cost. Indeed, UNE prices *per se* are not before the Commission, which is instead looking at various options for narrowing the application of the UNE regime to various pieces of the network infrastructure. While the two changes are comparable in their effect, it is possible that our "proxy" overestimates the impact of even the most aggressive changes the Commission could adopt.

Of greater concern, however, is the possibility that the Commission will equivocate, adopting half-measures, delaying implementation dates and/or leaving discretion to the states (many of which, based on recent history and their stated intentions, would either delay or simply refuse to adopt deregulatory reforms). To whatever extent the Commission fails to act decisively, the positive benefits of UNE reform we project for jobs and growth will not be realized, and the return to robust economic growth we all desire will be further delayed.

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most economists agree would spur further investment and, through the "wealth effect," increase consumer spending.

[36] We want to be extremely clear that our results are not in any way intended to suggest that UNE reform should be seen as a substitute for the tax policy changes proposed by the President. While we have not studied these proposals in any detail, as a general matter we are inclined as economists to believe they represent sound policy.

APPENDIX:
Assumptions and Methodology for Estimates of
Aggregate Impact of UNE Reform on Telecom Investment

As discussed in the text, the key variables that need to be taken into account in combining the various estimates of the impact of UNE on CAPEX are (1) the time period over which adjustments take place, (2) the extent of overlap among the various components of investment for which we have estimates, and (3) the extent to which secular growth in each market results in underestimates of the long-term effect. Finally, in cases where we have a range of estimates, we must choose among the high-end, the low-end and the mid-point.

Downside Case

The following assumptions are made in the "downside case."

1. We assume all adjustments take place over 10 years (except where the adjustment period is specified in the original study). However, we assume that investment in Fiber to the Home is "back loaded," so that investment over the course of the next four years runs at only half the average annual rate projected by CSMG, or $1.95 billion.
2. We assume the ILEC net plant estimate provided by Haring, Rettle, *et al* represents a 100-percent overlap with the estimate for investment in DSL deployment by Haring & Rolhlfs (even though the net plant investment also covers investment in traditional telecommunications facilities and even though investments in DSL are also being made by CLECs); and, half of the investment impact associated with high-speed lines in the Lehman study is also accounted for by the ILEC net plant figure (even though ILECs currently serve less than a third of all high-speed lines).
3. We take the low end of all estimated ranges.

On this basis, we calculate the annual impact of UNE reform as:

Sector (Study)	Annual Impact on Investment
Fiber to the Home (CSMG)	$1.95 billion
CLEC Facilities-based Lines (Crandall, *et al*)	$0.19 billion
ILEC Net Plant (Haring, *et al*)	$3.00 billion
High-Speed Lines (Other than DSL; Lehman)	$0.23 billion
Total	**$5.37 billion**

Upside Case

The following assumptions are made in the "upside case."

1. We assume all adjustments take place over four years (except where the adjustment period is specified in the original study), except we retain the 10 year assumption for the adjustment in overall ILEC net plant. With respect to FTTH, we continue to assume that investment is "back loaded," but less heavily so – running at two-thirds the annual rate projected by CSMG, or $2.57 billion. We adjust the point estimates for CLEC lines and DSL deployment to account for secular growth in these two markets. Based on the latest FCC data, these markets are growing at 25 percent annually and 76 percent annually, respectively.[37]
2. We continue to assume the ILEC net plant estimate captures all DSL deployment and adjust Lehman's estimate downwards by 50 percent.
3. We take the mid-point of all estimated ranges.

On this basis, we calculate the annual impact of UNE reform as:

Sector (Study)	Annual Impact on Investment
Fiber to the Home (CSMG)	$2.57 billion
CLEC Facilities-based Lines (Eisner & Lehman)	$1.65 billion[38]
ILEC Net Plant (Haring, *et al*)	$3.00 billion
High-Speed Lines (Other than DSL; Lehman)	$5.52 billion[39]
Total	**$12.74 billion**

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[37] See *Local Telephone Competition: Status as of June 30, 2002*, Federal Communications Commission, December 2002; and, *High Speed Services for Internet Access: Status as of June 30, 2002*, Federal Communications Commission, December 2002.

[38] Calculated as follows: We adopt the Eisner-Lehman estimate of $2.7 billion as the mid-point of the estimates provided by Eisner-Lehman and Crandall, *et al*. We adjust this figure upwards to $6.59 billion to reflect four years of secular growth at 25 percent per annum, then divide by four to arrive at an annual figure of $1.65 billion.

[39] Calculated as follows: We assume that half of the $4.6 estimate provided by Lehman constitutes non-DSL deployment, producing a baseline figure of $2.3 billion. We adjust this figure upwards to $22.06 billion to reflect four years of secular growth at 76 percent per annum, then divide by four to arrive at an annual figure of $5.52 billion. (Compare this figure with the Haring-Rohlf estimate for DSL only, which is $13 billion over three years. Dividing by three to get an annual figure implies an annual impact of $4.33 billion annually, which is consistent with our estimate for non-DSL investment based on the fact that cable and DSL have approximately equal shares.)